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Attention in preschool children with and without signs of ADHD.

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Chapter 1. Introduction

1.1 The Hyperactive Boy

"The child sat behind the screen of a computer. In front of him there was a response tableau, with two hand-shaped buttons and a big, red response button in between. I explained to the child that each time a small, white dog appeared on the screen, he was expected to push the red button as quickly as possible 'to bring the dog back home'. After a correct response the dog ran to the corner of the screen and disappeared to where his home was supposed to be. But before I finished my explanation, the child interrupted me and asked what was underneath the buttons. And how the computer could be turned off. After many of these interruptions he was finally ready to start the game. He gave three, maybe four correct responses. Then his attention was drawn by the curtain in front of the window. "Why did you close the curtains?" he asked. And without waiting for my response, he jumped off his chair and tried to look through the window. I asked him to return to the game. Again, he gave two correct responses. Then he turned off the screen. And lifted the response tableau to see what was underneath the buttons. Then he tried to push the buttons with his elbows. Or with the left hand on the right button and the right hand on the left button. Then he jumped off the chair again and rushed to the door: he heard someone walking in the hall. After my request to return to the game he laid his head on the response tableau. "I'm tired", he said."

"Two days later I saw the same boy again. This time he was playing in the observation room with some toys. His teacher accompanied him. The room was empty, except for some items of furniture which were placed against the walls. After two minutes of playing with the toys he walked toward the one-

way screen and started to pull faces in the mirror. Then he started to imitate Axel Rose, singing 'knocking on heaven's door'. After a short while he rushed back to the toys and played with them. This playing lasted one minute, then he threw a car through the room. "This is a car accident", he told his teacher, and threw a second car towards the first one. He rushed towards the windows and tried to balance on the window-sill. This activity also didn't last longer than two minutes. He noticed the furniture against the walls of the observation room and started to pull the table towards the other side of the room, climbed upon it to see what was lying on top of the cupboard. But the table wasn't high enough, so he told his teacher to get off the only chair in the room, so he could put it on the table in order to climb somewhat higher."

1.2 The Definition Problem

I made the observation of this 5-year-old boy at a Medical Day Care Centre. He is clearly a hyperactive boy. According to Henker and Whalen (1989) "hyperactivity is in the eyes of the beholder (....) these children send salient signals to other people - signals that seem to spell trouble even before it occurs". But despite the clearly observable signs, after decennia of research on this topic, there still exists disagreement about the exact origin of the hyperactive child's problems. This disagreement is clearly demonstrated in various labels used to refer to this phenomenon, like 'Minimal Brain Damage', Minor Brain Dysfunction', 'Minimal Brain Dysfunction". Until recently, the terms attentional deficit disorder (ADD) and attentional deficit disorder with hyperactivity (ADD-H) have been used internationally (DSM-III, American Psychiatric Association, 1980) to identify children with these particular problems. In the revised version of this manual (DSM-III-R, American Psychiatric Association, 1987), the terms ADD and ADD-H have been replaced by Attention Deficit Hyperactivity Disorder (ADHD). But to accentuate the confusion, the American Psychiatric Association states in the "DSM-IV options book: work in progress" (1991): "For DSM-IV, it is proposed that the list of ADHD symptoms be divided into either two groupings (i.e., inattention and hyperactivity/impulsivity, which is in line with some but not all empirical findings) or three groupings (i.e., inattention, hyperactivity, and impulsivity, as in DSM-III). This proposed change is meant to increase clarity concerning the relationship between Attention Deficit Disorder with and without Hyperactivity, and to make the criteria set easier to remember." Eventually, DSM-IV (American Psychiatric Association, 1994) distinguishes three subtypes of the Attention-Deficit/Hyperactivity Disorder:

Attention-Deficit/Hyperactivity Disorder, Combined Type; Attention Deficit/Hyperactivity Disorder, Predominantly Inat-tentive Type; Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type (pp. 78-85).

What precisely are the problems of the hyperactive children? Table 1 gives an overview of the diagnostic criteria of ADHD according to DSM-IV.

Table 1. Diagnostic criteria for Attention-Deficit/Hyperactivity Disorder, according to DSM-IV

A. Either (1) or (2):

(1) six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Inattention

(a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
(b) often has difficulty sustaining attention in tasks or play activities
(c) often does not seem to listen when spoken to directly
(d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
(e) often has difficulty organizing tasks and activities
(f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
(g) often loses things necessary for tasks or activities (e.g. toys, school assignments, pencils, books, or tools)
(h) is often easily distracted by extraneous stimuli

(2) six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

Hyperactivity

(a) often fidgets with hands or feet or squirms in seat
(b) often leaves seat in classroom or in other situations in which remaining seated is expected
(c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)

(d) often has difficulty playing or engaging in leisure activities quietly
(e) is often "on the go" or often acts as if "driven by a motor"
(f) often talks excessively

(continued)

Table 1. (continued) Diagnostic criteria for Attention-Deficit/Hyperactivity Disorder according to DSM-IV

Impulsivity
(g) often blurts out answers before questions have been completed
(h) often has difficulty awaiting turn
(i) often interrupts or intrudes on other (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present befor age 7 years.

C. some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

Code based on type:
314.01 Attention-Deficit/Hyperactivity Disorder, Combined Type: if both Criteria A1 and A2 are met for the past 6 months
314.00 Attention-Deficit/Hyperactivity Disorder, Predominantly Inattentive Type: if Criterion A1 is met but Criterion A2 is not met for the past 6 months
314.01 Attention-Deficit/Hyperactivity Disorder, Predominantly Hyperactive-Impulsive Type: if Criterion A2 is met but Criterion A1 is not met for the past 6 months

Coding note: For individuals (especially adolescents and adults) who currently have symptoms that no longer meet full criteria, "In Partial Remission" should be specified.

According to this manual, the essential feature of ADHD is a persistent pattern of inattention and/or hyperactivity-impulsivity that is more frequent and severe than is typically observed in individuals at a comparable level of

development. Although it is stated that some impairments must have been present before age 7, DSM-IV recognizes that "it is especially difficult to establish this diagnosis in children younger than age 4 or 5 years because their characteristic behavior is much more variable than that of older children and may include features that are similar to symptoms of ADHD. Furthermore, symptoms of inattention in toddlers or preschool children are often not readily observed because young children typically experience few demands for sustained attention." (p. 81). At school, the child is required to sit still for prolonged periods, listen to the teacher, and concentrate on his work. Because these demands are not made in the period before school entrance, the problems of most young hyperactive children remain obscure. Furthermore, the problematic behavioral pattern of the older ADHD child is mostly considered as a normal behavioral pattern in preschool children (see also Campbell, 1985). The general problem that we will address in the present study is: is it possible to diagnose ADHD before school entrance? Unfortunately however, only a few studies have tried to find early precursors, other than clinical or parental impressions, of later attention deficits (Ruff, Lawson, Parrinello, & Weissberg, 1990) and to develop objective measures for the early diagnosis of ADHD. Moreover, studies concerning normal development of attentional processes - for example sustained attention - in the age-range of about 2-6 years are scarce (Ruff & Lawson, 1990). The present study is an attempt to obtain a better understanding of the normal and deviant development of attentional processes during the preschool years.

1.3 Attention in Young Children: Plan of the Study

In this study, we will address the following two questions:

1. How do attentional processes develop in the age range from 2 to 6 years?
2. Is it possible to develop an instrument for the early diagnosis of children with ADHD?

Because, as we argued before, very little is known about either the normal or the deviant development of attentional processes during the preschool years, it will be difficult to formulate a theoretical starting point that can be adapted to the study of attentional processes in preschool children with and without ADHD. In chapter 2 we shall give an overview of various leading theories on attention and its development. Two methods will be reviewed: the information processing approach and the ethological approach.

Within cognitive psychology the information processing theory with its coherent system of models and methods is seen as an important approach which can be applied to the study of normal and deviant cognitive development. Methods derived from this theory are used intensively to study attentional processes in adults, adolescents, children from 7 years and older, and ADHD children of the same age. We shall try to extrapolate the knowledge from these methods for the study of attentional processes in normal and ADHD preschool children. The information processing approach has some major disadvantages. Firstly, the huge number of studies on this topic mainly address adult information processing. Secondly, the method of studying the cognitive processes involves the use of reaction time tasks, which are very demanding for young children.

Another important approach to the study of these processes in young children is the ethological approach, which focuses on the behaviors of the children during free play. The advantage of this method is clear: there will be no problems observing preschool children during free play. Furthermore, it gives us the possibility to observe the children in a semi-natural environment. However, the method has also some disadvantages: the free-play situation is loosely structured and therefore the different types of behaviors displayed are numerous and hard to define. Consequently, it may be quite difficult to obtain a clear picture of the processes we are interested in.

Although the methods presented here are quite different, they may complement each other and, in combination, provide us with a better understanding of developmental aspects of attention in preschool children.

In chapter 3 we will focus on the measurement of attentional processes by means of a reaction time task, as used in most studies derived from information processing paradigms. The focus is on the output-related aspects of human information processing: response preparation and response inhibition. These abilities are part of the so-called output-related processes or executive functions, which play an important role in the choice, preparation, and inhibition of inappropriate strategies (Logan, 1985). From a developmental point of view, it is expected that younger children will have more problems with efficient response preparation than older children (Luria, 1959; Wickens, 1974; Chi & Gallagher, 1982). Furthermore, Bjorklund and Harnishfeger (1990) propose that, with development, changes in children's neurological system lead to increased efficiency of inhibitory processing, contributing to increases in selective attention and in the ability to keep task-irrelevant information out of working memory. In studies on (older) ADHD children, it

was found that ADHD children have more problems with 'the readiness to respond' (Van der Meere, Vreeling, & Sergeant, 1992) and response inhibition (Tannock, Schachar, Carr, Chajczyk, & Logan, 1989; Schachar & Logan, 1990). So the two abilities under focus seem to be robust discriminators between children of different ages as well as between ADHD children and control children. Two questions have to be answered: Firstly, is this also the case when studying younger children, and secondly, is this method, using a reaction time instrument, appropriate for testing children from two to six years? In our study, we use additional behavioral observations, to check for the possible variability in degrees of freedom between children from different groups.

In chapter 4 we focus on attentional processes in young children during a free play situation. The so-called task orientation of the children can be divided in exploration and play (Berlyne, 1960; Hutt, 1970; Weisler & McCall, 1976). Ruff and Lawson (1990) found changes over age in the way children concentrate and sustain attention spontaneously during free play. Older children show higher frequencies and longer episodes of attention than young children. Whereas the attention of the young children is more strongly directed by the physical characteristics of the toys (exploration: "what does this object do?"), the attention of older children is focused more on open-ended activities like construction and play. The literature concerning the quality of play behavior focuses on more aspects than just the developmental ones. Touwen and Kalverboer (1973) found that children with slight neurological dysfunctions show less exploration, more low-level play and more shifts of activity than control children. Alessandri (1992) found that ADHD children engaged in less overall play and more nonplay behavior than control children. Because the cited literature not only takes the quality of play behavior into account, but also the nonplay behavior, we will observe diverse aspects of the (play and nonplay) acitivities of the children in the free play behavior.

In chapter 5 the focus is on the ADHD group alone. Some of the children in our study participated in both the reaction time study and the free play observation study. These children were all recruited from Medical Day Care Centres and were selected on the following criteria: signs of ADHD and no other deficit. In this chapter we combine different types of variables: behavioral observation scales, filled in by the parents of the children and their teachers, reaction time data from both the response preparation study and the response inhibition study, behavioral observation measures obtained during the reaction time tasks, and behavioral measures from the free play observations. The first question that will be addressed in this chapter is whether there

are relationships between the different variables. Do they overlap, can they be combined, or do they measure different aspects of the attentional processes and behavioral characteristics in preschool ADHD children? Based on the different clusters formed with factor analysis we will use cluster analysis in an attempt to identify subgroups of ADHD children. The method behind the identication of subgroups is to critically evaluate our selection method. The selection of the ADHD group was based on practical criteria, not on a specific diagnosis. Does the group we selected form one coherent group, is it in fact composed of different subgroups, or is it just a melting pot of all kinds of problem children? To what extent can our findings contribute to a better understanding of the disorder? How can we relate our group to well-known diagnostic criteria like DSM-IV (American Psychiatric Association, 1994) and ICD-10 (World Health Organization, 1992)? The relevance of these questions stems from the fact that this study attempts to contribute to the development of an instrument for the early diagnosis of ADHD children. This means that the 'ADHD' children in our study could not be drawn from an existing 'ADHD'-population, because most children were too young to obtain the diagnosis according to the existing criteria. Therefore, the way the children were selected in our study should be scrutinized very critically.

In the last chapter we summarize and discuss the findings from the studies presented in previous chapters. What is the additive merit of this study? Are the findings promising enough for the future development of diagnostic methods that can contribute to the early detection of ADHD children? We also critically examine the methods and approaches we employed in our study. We shall review the shortcomings of the used methods, and give some recommendations for future research.

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